Saudi Journal of Ophthalmology (2010) **24**, 45–48

King Saud University

Saudi Journal of Ophthalmology

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ORIGINAL ARTICLE

Prevalence of refractive errors among pre-school children at King Abdulaziz Medical City, Riyadh, Saudi Arabia

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Received 7 December 2009; accepted 12 January 2010
Available online 4 February 2010

KEYWORDS

Refractive errors;
Prevalence;
Pre-school;
Saudi

Abstract *Background:* Vision disorders are the fourth most common disability of children and the leading cause of handicapping conditions in childhood. The present study was undertaken to identify the prevalence and pattern of refractive errors among the school-entrant children at King Abdul Aziz Medical City (KAMC), Riyadh city – Kingdom of Saudi Arabia.

Methods: The study population consisted of all the school-entrants (n = 1319), who attended the obligatory health examination for kindergarten and primary school entry during the period from March 2008 until October 2008. Every child was subjected to a 10 min – visual acuity test (VAT) and autorefractive test applied by qualified optometrist. Children with a visual acuity of 20/28 or worse in one or both eyes, or with eye disorder (strabismus, nystagmus, ptosis and others) or abnormal ocular movement, were referred for a 45 min complete ophthalmic examination, which consists of: (1) Distance visual acuity (V/A), (2) cover – uncover test, and (3) non-cycloplpegic retinoscopy. Refractive error cut-off point was defined according to their spherical equivalent refractive error (SERE).

Results: Out of the 1319 children, 60 children were diagnosed as having one or more refractive error, with an over-all prevalence of 4.5% (4.2% in boys and 4.9% in girls) with no sex difference. Prevalence of different refractive errors were as follows; Myopia (2.5%, 95%CI1.7:3.3%),

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doi:10.1016/j.sjopt.2010.01.001

Production and hosting by Elsevier

hyperopia (2.1%, 95%CI 1.3:2.9%), astigmatism (2.5%, 95%CI 1.7:3.3%), amblyopia (0.5%, 95%CI 0.1:0.9%) and strabismus (0.5%, 95% CI 0.1:0.9%).

Conclusion: Our results raise the need for school-based program that provides prescription glasses when needed to students at no cost, through government and non-governmental collaborative fund. However, there is a need for further studies to evaluate the cultural beliefs towards the use of spectacles in Saudi communities.

1. Introduction

Vision disorders are the fourth most common disability of children and the leading cause of handicapping conditions in childhood (Ciner et al., 1998). In pre-school-age children, amblyopia, and amblyogenic risk factors such as strabismus, and significant refractive error are the most prevalent vision disorders (Ciner et al., 1998; Abolfotouh et al., 1993; American Optometric Association Consensus Panel on Pediatric Eye and Vision Examination, 2002; Moore, 2006). Vision screening to detect eye problems in school-aged children dates back at least a century (Appelboom, 1985). The emphasis was placed on vision screening in the pre-school years. Pre-school screening programs have been adopted in various countries (Lennerstrand et al., 1995). The purpose of the pre-school visual screening is to identify children with possible visual problems early, ensuring appropriate timely assessment and early intervention as required. Treatment of amblyogenic hyperopia, astigmatism, anisometropia and myopia can prevent legal blindness and vision loss (Braverman, 2007). The lack of refraction and spectacle provision in eye care services in underserved communities has important consequences in terms of lost educational and employment opportunities, which result in impaired quality of life (Larry et al., 1997).

Although the Scandinavian experience (Kvarnstrom et al., 1998). and other data make clear the effectiveness of pre-school screening in reducing visual morbidity from amblyopia (Newman et al., 1996), yet the Saudi school health services provided by ministry of education does not include adequate vision screening facilities (Wedad et al., 2002). Medical examination is obligatory for all school entrants in accordance with government laws and authorized by the educational and health authorities at the National Guard. The present study was undertaken to estimate the prevalence and pattern of refractive errors among school entrant in School heath center at King Abdulaziz Medical City (KAMC) Riyadh, Kingdom of Saudi Arabia.

2. Methodology

2.1. Study setting

Riyadh City has 6 million inhabitants. The Population of the National Guard in Riyadh is around 180,000 inhabitants. Of those, 60,000 live in King Abdulaziz National Guard Housing City, East quarter of Riyadh. A total of 54 schools are present in this city with student population around 18,000 students. School entrants ages 4–8 years constitutes about 10 % of the total school population.

2.2. The study population

The target schools are 38 schools. The target population consisted of 1319 (577 boys and 742 girls) Saudi children. It included all children from both genders aged 4–8 years, who attended the obligatory health examination for kindergarten and primary school entry during the period from March 2008 until October 2008. Children below 4 years or above 8 years and disabled children were excluded. Data used in this study were collected from relevant clinical data taken routinely during medical examination. The study did not involve experimental investigations.

2.3. Methods

At the beginning of the academic year 2008–2009, all school entrants were brought by their parents to the school health center at KAMC. Part of the medical examination was a 10 min visual acuity test (VAT) and auto refractive test was applied by qualified optometrist. Children with a visual acuity of 20/28 or worse in one or both eyes, or with eye disorder (strabismus, nystagmus, ptosis and others) or abnormal ocular movement, were referred – in a month- for longer 45 min of complete ophthalmic examination which consists of:

(1) *Distance visual acuity V/A*. All children underwent a full assessment of uncorrected visual acuity, using an Auto chart Projector (CP 670; Nidek Co. Ltd, Gamagori, Japan), where Snellen chart picture and figures (Cat, Flowers, Sun, Bird and Car). The Child was positioned at 6 m distance from well-lit Snellen chart. When performing Visual Acuity each eye were tested independently, first we test the Child's right eye by covering the left eye, the same procedure was repeated by covering the right eye. Children were instructed to identify the letter or the Optotype figure on the monitor verbally or by pointing to the Optotype on the handled card. We record the smallest line where the child read's more than half the letters.
(2) *Cover–uncover test*. Eye alignment was assessed using a cover-uncover test at both distance (3 m) and near (40 cm). The screener asks the child to look at a detailed, standardized fixation target and places a cover paddle over the child's left eye. The paddle was kept in front of the eye for approximately 3 s. The screener observes the unocluded right eye to determine if refixation occurs. The cover-uncover stroke was repeated at least 3 times. The procedure was repeated, covering the right eye.
(3) *Non-cycloplegic retinoscopy*. The screener uses a streak retinoscope and a retinoscopy lens rack or handheld trial lenses. The child wears retinoscopy spectacles corre-

sponding to the screener's working distance to control accommodation.

(4) *Power auto-refractor*. The power refractor II (version 3.11.01.24.00) is a tabletop video/photorefractor that binocularly measures refractive error in 8 meridian and measures eye alignment. When the child fixates on the red and green lights on the camera, the screener begins the measurement and continues until the refractive error in each eye and gaze deviation appears in green on a display or until the instrument times out. The screener prints the display image, if the refractive error displayed for either eye was red, the measurement of the highlighted eye(s) is repeated. If the output for either eye is again red, measurement may be made monocularly.

The quantification of refractive error is not straightforward because refraction comprises three components namely: sphere, cylinder and cylinder axis, all of which contribute to the visual outcome (Larry et al., 1997). Refractive error was quantified as the spherical equivalent refractive error (SERE), which is the algebraic sum of the sphere power plus, half the cylinder power, the Unit being dioptre (D) Powell et al., 2006.

Refractive error cut-point was defined according to their SERE as follows, Emmetropia as SERE between −0.50 and + 0.50 diopter sphere, Myopia low and High as SERE less than −0.50 and −6.00 D, respectively **(**Clinical practice guideline care of the patient with myopia American Optometric Association Consensus panel on care of the patient with myopia et al., 1997). The cut-off points for hyperopia low and high as SERE + 2.00 D and + 6.00 D, respectively.

2.4. Data management

Data was analyzed using SPSS software program. Percentage and 95% confidence interval were used to describe the prevalence and distribution of the different eye disorders. Pearson Chi-squared test was applied for qualitative data. A *P*-value of < 5% was considered statistically significant.

3. Results

Table 1 shows the distribution of 1319 screened school entrants (577 boys and 742 girls), according to the over-all results of vision screening. Their age ranged from 4 years to 6 years.

A total of 92(7%) children were detected by screening and referred for further examination. Of those, 60 children were diagnosed of having one or more eye problem constituting an over-all prevalence of 4.5% (4.2% for boys and 4.9% for girls).There was no sex difference with regard to the prevalence of refractive errors ($X^2 = 0.22$, $P = 0.64$).

Table 1 Distribution of schools-entrants according to the over-all results of vision screening – @ yates corrected chi-squared test was applied.

Gender	No. screened	Referred (%)	Abnormal			Sex differences
			N	%	95%CI	
Boy's	577	36 (6.2)	24	4.2	3.1:5.3	$\chi^2 = 0.22$
Girl's	742	56 (7.5)	36	4.9	(3.7:5.1)	$P = 0.64$
Total	1319	92 (7.0)	60	4.5	3.4:5.6	

Table 2 shows the distribution of 60 children with refractive errors according to the different abnormalities more than one-half of cases suffered from Myopia (55%), giving a prevalence of 2.5%, 95% CI 1.7:3.3%. However those with high myopia constituted 12.1% of all myopic children. Astigmatism was shown in another one-half of children with a prevalence of 2.5%, 95% CI 1.7:3.3%. Hyperopia ranks 3rd with a prevalence of 2.1%, 95% CI 1.3:2.9. Squint was prevalent in 11.7% of all cases, with a prevalence of 0.5%, 95% CI 0.1:0.9%. Six amblyopic children were detected after exclusion of eye abnormalities, giving a prevalence of 0.5%, 95%CI 0.1:0.9%.

4. Discussion

Worldwide, the leading cause of reduced vision in children is an unidentified need for them to wear glasses. The reduced vision that results from abnormal focusing (refractive error) can cause the children to squint their eyes and complain of headaches. Reduced vision may affect academic performance, choice of occupation and socio-economic status in adult life **(**Powell et al., 2006).

The Prevalence of refractive error in our study was (4.5%) which is far less than 23% in the high altitude Abha study (Abolfotouh et al., 1993), and less than another local study in Jeddah city (10.7%) Wedad et al., 2002 at sea level. It is less than Malaysian study (17.8) Goh et al., 2005, but more than those of similar age Iranian (3.9%) Khalaj et al., 2009, and Indian studies (Murthy et al., 2002). The prevalence of myopia in pre-school children is different in different countries. In our study, it was 2.5% (at least −0.5 D) which is double the figure of 1.8% in similar two studies in S.A (Abolfotouh et al., 1993; clinical practice guideline care of the patient with myopia American Optometric Association Consensus panel on care of the patient with myopia et al., 1997), but less than 8.2%, 5.3% and 7.7% in Iran (Khalaj and M., 2009), India (Murthy et al., 2002) and South Africa (Naidoo et al., 2003).

The prevalence of hyperopia has varied in different studies in different populations depending on the criteria used, In our study, it was 2.1% (at SERE greater than +2 D), while It was 1.8% (at same Diopter) in South Africa (Naidoo et al., 2003), 2.96% (at SERE greater than +3.5D) in Malaysia (Goh et al., 2005), but less than15.6% (at SERE greater than +4 D) in an Indian study (Murthy et al., 2002) and 16.5% (at SERE greater than +0.5 D) in an Iranian study (Khalaj et al., 2009). Mild hyperopic (+2 to +4 D) is common in children. It is generally not considered to be a problem unless it interferes with education (William et al., 2005).

The prevalence of astigmatism has varied in different studies in different populations. In our study, it was 2.5%, which is less than 5.4% in New Delhi study (Murthy et al., 2002), and <21% in Chinese pre-school population (Fan et al., 2004). By our vision screening programme, we have detected six children with amblyopia and seven cases of strabismus with prevalence rates of (0.50% and 0.53%), respectively. Those children were lucky to receive the appropriate management in the appropriate time. In accordance with WHO's global initiative "Vision 2020" The right to sight (http://www.v2, xxxx), a professional based (optometry) screening program for all pre-school and

Table 2 Prevalence of refractive errors among school-entrants of KAMC – Riyadh.

Refractive errors	Cases: (n = 60)		Prevalence (%) (N = 1319)	95%CI
	n	%		
Myopia				
Mild (−0.5 to less than −3 D)	25	75.8*	1.9	1.2:2.6
Moderate (−3 to less than −6 D)	4	12.1*	0.3	0.0:0.6
High (greater than −6 D)	4	12.1*	0.3	0.0:0.6
Sub total	33	55	2.5	1.7:3.3
Hyperopia				
Mild (+0.5 to less than +3 D)	23	85.2*	1.7	1.0:2.4
Mod. (+3 to less than + 6 D)	3	11.1*	0.2	0.0:0.4
High (greater than + 6 D)	1	3.7*	0.1	−0.1:−0.3
Sub total	27	45	2.1	1.3:2.9
Astigmatism	33	55.0	2. 5	1.7:3.3
Squent(strabismus)	7	11.7	0.5	0.1:0.9
Amblyopia	6	10.0	0.5	0.1:0.9

* Percentage were calculated out of the sub totals.

school-aged children is recommended to provide an early detection and initiate early treatment. Our results raise the need for school-based program that provides prescription glasses when needed to students at no cost, through government and non-governmental collaborative fund. However, there is a need for further studies to evaluate the cultural beliefs towards the use of spectacles in Saudi communities.

Acknowledgements

This study was approved by King Abdullah International Medical Research Center (KAIMRC) RR09. The Author is thankful to Professor Mostafa Abolfotouh at King Abdullah International Medical Research Center (KAIMRC), for his valuable effort in revising and editing the manuscript.

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